Unit 1: Components of a Computer
(1a. Components and Performance of Processors, A Level Only Content)

Marks: /9

Answer **all** the questions.

1(a). The following is a program written using the Little Man Computer instruction set.

```
start  LDA   one
       OUT
       LDA   zero
       OUT
       LDA   count
       SUB   one
       STA   count
       BRP   start
       HLT
one    DAT   1
zero   DAT   0
count  DAT   3
```

Explain, giving an example, how pipelining in a CPU could speed up the execution of this program.

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[3]

(b). Describe **one** issue the line `BRP start` may cause for a CPU using pipelining.

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[2]

(c). Pipelining is one factor that affects the performance of a CPU. Identify **one** other factor.

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[1]

2. A Little Man Computer (LMC) assembly language program is stored in memory as shown in Fig. 3.1.

0	LDA &7
1	ADD #4
2	OUT
3	HLT
4	6
5	2
6	10
7	15
8	16
9	17

Fig. 3.1

In this variant of LMC the symbols & and # are used to denote different modes of addressing.

Explain how pipelining would help a CPU execute the code in Fig. 3.1 more quickly.

---[3]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		– An instruction can be fetched as the previous one is being decoded … – … and the one before that is being executed. – E.g. `LDA Zero` can be fetched, while `OUT` is being decoded and `start LDA one` is being executed. (1 per –)	3	
	b		– BRP could be followed by one of two possible instructions, which one will only be determined at execution – Meaning the wrong one may be fetched / decoded (1 per –)	2	
	c		– Clock speed – Cache Size – Number of cores (1 per max 1)	1	
			Total	**6**	
2			Pipelining would allow one instruction to be fetched as the previous one is being decoded and the one before that is being executed.(1) For example OUT could be fetched (1). As there are no jump/branch instructions it pipelines well (as there is no need to flush the pipeline). (1)	3	Accept any valid example from the given code.
			Total	**3**	